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AUTHOR	Loomis, Challie
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ABSTRACT

A teacher's daily record of activities and strategies for teaching arithmetic to a class of first grade students exclusively through the use of Cuisenaire rods is described. Worksheets and the mid-term test are included. A short evaluation of the results of the instructional method concludes the paper. (DT)

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CUISENAIRE

Daily Calendar of a Primary One Teacher

"How-I-Did-It"

by

Challie Loomis

Jackson Park School
School District of University City, Missouri
September 1, 1965

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My Cuisenaire Calendar

During the school year 1964-65 arithmetic will be taught to my Primary One children by the use of Cuisenaire rods exclusively. No other formal workbooks or publishing company's materials will be used very seldom. This is an experimental approach at Jackson Park School. We have worked before with Cuisenaire materials -- but always with other workbooks to vary or supplement our teaching. A brief daily account of how I developed my math teaching may be helpful to me -- and, I hope, to other teachers.

This primary classroom is equipped with trapezoidal tables -- ideal for many arrangements. Two children will be seated at a table -- with a large box of Cuisenaire rods (or half of a large box) for each two or sometimes three children. Our one long formica top table is ideal for a small group of eight to work with me -- and we will at times work in these smaller groups. For best results in Cuisenaire teaching it seems helpful to have a pleasant environment with several possible flexible arrangements of pupils.

This group of 29 Primary One children consists of 14 boys and 15 girls. Reading readiness scores and kindergarten teacher's judgements seem to indicate a group potentially capable of good average or superior work -- with only a few immature children -- and no seriously disturbed (or disturbing) children.

This commentary or calendar is written informally as it happened day by day.

In June I will hope to be able to have some helpful conclusions. Much of the work will be taught by the "discovery" method -- Both children and teacher will be discovering!

Sept.8 - FREE PLAY EXPERIENCE

Taught handling of box and care of rods. During the 20 minute free play time there was a 100% interest and all children made something.

I used certain words in casual comment or conversation when applicable: --

same-different; above-below; short-long; many-few, design-pattern.

The children told me what they were making only if they wanted to tell. After putting rods away there was one question asked by all children. "Can we do this tomorrow? It"s fun!"

Sept. 9 - FREE PLAY EXPERIENCE (Same as Sept. 8)

Some more interest in pattern or design arrangements. After rods were put away I asked two questions:

"What color was the shortest rod?"

"What color was the longest rod?"

(Good response)

Sept. 10 - FREE PLAY AND CREATING ONE THING

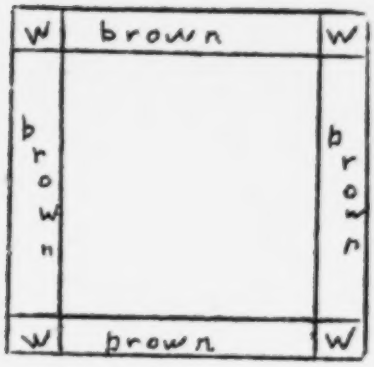
After a short free play experience, the children were asked to make one pretty thing to show their classmates.

After 15 minutes the children walked around to look at each other's creations. Some rods were carelessly or accidentally knocked down and we discussed being careful of other's work.

Sept.11 - A PUZZLE TO FILL IN

Can you fill in this picture frame? Be sure you leave no empty spaces.

(Sept.11 - cont'd)



The teacher helped some to build their picture frame correctly. All 29 could completely fill their frames -- then enjoyed free play.

Sept. 14 - GETTING THE "FEEL" OF THE RODS

After free play -- we took one white, one red and one light green to hide behind our backs -- and by feel found the right color.

"Show me the shortest one."

"Show me the longest one."

"Can you find the red one?" etc.

Riddle: "I am not the longest. I am not the shortest. I am_____?"

Sept.15 - GETTING THE "FEEL" OF THE RODS (Same as Sept. 14)

With purple, yellow, dark green.

Sept. 16 - GRAB BAG GAME

Children laid out one of each color of rods on the table -- and were encouraged to "feel them carefully." Then they reached in my grab bag with one hand and said: "I think I have a _____ rod." About half were"magicians" -- they found the color correctly. Others missed by one step (one color) only. A few had no concept of relationship between seeing them on their desk, feeling them in the grab bag and guessing correctly.

Sept. 17 - THE GRAB BAG (With discovery of "steps" in the rod sequence)

One or two children arranged their rods in a step pattern when they laid them out before we played "Grab Bag". I commented on it as being "very nice" "pretty" etc. and several more followed the step pattern arrangement.

Sept. 18 - THE STAIRCASE

We all made steps and "walked" up the steps using our fingers. (The rods were placed in a perpendicular arrangement to make the steps seem more real)

Sept. 21 - THE TRAIN GAME

"Lay an orange rod down on your table. How many trains of 2 or 3 or more cars can you make? Each train must be exactly as long as this orange one." (No limitation of patterns repeated again and again). After several minutes "count how many trains you made."

Sept.2[illegible] - THE RODS AS THINGS TO BE COUNTED

It was necessary to count and redistribute some of the rods because of uneven numbers in boxes. We counted by ones for some colors, by "twos" by 5's -- and children had the experience of arranging or manipulating rods for easy counting.

Sept. 23 - DESCRIBING THE RODS

(Each day unless stated otherwise there was always a free play experience time). Then I asked the question: "Suppose your mother or father asked you about the rods. What would you tell them?" (I am encouraging use of sentences and all answers were developed eventually into complete sentence idea:) --

"pieces of wood"
"different colors"
"you make things with them"
"you can balance some pieces on others"
"all different sizes"
"different shapes long-ways"
"we build steps"
"we make towers"
"we make designs"
"we make pictures"

Sept. 24 - TWO WAYS TO DRAW THE RODS

After the children made the rods into steps and "walked up" them, they put them away. I drew the rods on the chalk board in their proper proportions -- children could name the colors properly. (Recognition by length only) The children then rebuilt their actual rod steps and drew them in color on 1 inch square paper. 1 in = 1 cm rod square

They frequently referred to the actual rods in front of them -- (only 3 children omitted colors or forgot to increase length of each step)

Sept. 25 - FEELING FOR THE RODS

Children put one of each rod out on desk in a mixed arrangement. I covered each child's rods with a large paper towel. Then we played "find the rod" by reaching under the paper and feeling for it as directed. Later they reached under their paper towels and pulled out rods to build steps -- trying each time to pull out the next successive color step on the first trial.

Sept. 28 - BEGINNING OF 2 RODS

"Trains" and complementary patterns. By making "trains" for orange rod - with only 2 "cars" - children discovered that colors could be reversed as blue-white, white-blue, etc. etc. (Beginning of the commutative concept)

Sept. 29 - "TRAINS"

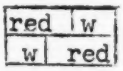
"Trains" for blue rod - brown rod. Children told me what they had discovered. Encouraged the reversal or complementary patterns.

Sept. 30 - REMEMBERING AND DRAWING THE STEPS IN COLOR

After free play, the children put away the rods and drew the staircase pattern on 1 inch squared paper from memory. Of the 26 children present 20 got their drawings exactly right. Only one mistake in color placement. Others forgot to increase lengths of rod properly.

MY CUISENAIRE CALENDAR

October 1, 1964 - USING 5 RODS

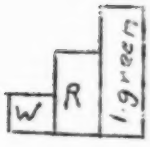
(White -red - light green and purple) "We will make patterns like this one." Teacher demonstrated  and helped each child to do it.

"How many other 2 color patterns like this can you do?" Three children achieved 10 distinct correct patterns. Average was about 6 patterns. They "read" their patterns to me -- as "red and light green" "light green and red."

October 2 - USING 3 RODS ONLY

(White -red- light green) "Make patterns like you did yesterday." As the children "read" their patterns to me I drew them with black crayola on white paper in proper sizes. Later the children "read" my patterns back to me -- after they had put away their rods. This was identification by relative length only -- and began the "feel" of addition..as red and light green..white and red, etc.

October 5 - SHORTER THAN - LONGER THAN

Children illustrated with various groups of 3 consecutive rods, as  and told their stories of shorter than- longer than. (After many stories they discovered that a single rod can be either "taller than" or "shorter than" depending on its position with other rods. Puzzle: "What rod can not say "I am smaller than" (O); "What rod cannot say 'I am bigger than?'" (w)

October 6 - REVIEW OF SKILLS

A Washington University education student wanted to see Cuisenaire rods in operation to report to her math class. We reviewed sequence steps, patterns, complementary patterns, "trains" (permutations) and commutatity and our newest skill -- of comparison of lengths of rods.

October 7 - BEGINNING OF ADDITION - WITH USE OF TERM "EQUALS."

The children were asked to put out a 2 car train of red and yellow and asked to find one rod that was just as long. They told the story first as " The red rod and the yellow rod together are the same length as the black rod." Teacher: "We know equal means "the same as" as equal shares of candy. "We can say 'The red and yellow equals the black' or 'the yellow and the red equals the black.'" Children made other addition stories with rods and told their "equals" stories.

October 8 - ADDITION - DICTATION.. FINDING ANSWERS

Teacher dictated 10 different 2 rod stories which the children constructed as they heard them. Then the teacher said "Now find the rod that will exactly equal each one of your rod groups. "Try to pick the right one the first time." Most of them worked quickly and accurately and then told me an addition story (color names only).

October 9 - A ROD PUZZLE

Children were given the mimeographed scale drawings or rods in various groupings. "This is a puzzle. "How well can you put the color rods on the right spaces so that they fit exactly?' At the end of about 10 minutes we named the winners. The student teacher was asked to note "winners" and check later against a list of reading readiness scores. We found a high correlation between high reading readiness scores andwinners who had completed all spaces quickly and accurately.

October 12 - DISCOVERING ADDING STORIES (PERMUTATIONS)

Beginning with the brown rod children were asked to discover "how many different 2 car trains - or adding stories can you make?" One bright child soon remarked: "I had to quit because there are no more new 2-rod adding stories I can make for the brown rod." He told the ones he had made

October 12 - Cont'd.

and class agreed he was right. They experimented with other colors and discovered it was true -- Only a certain number of different 2 rod stories can be made for any color.

October 13 - SAME AS OCT. 12 (DISCOVERING ADDING STORIES) BUT USING THREE RODS IN AN ADDING STORY TO EQUAL ANY GIVEN ROD

Children discovered they could make many more different adding stories with the three rods. Each child told one adding story he had constructed. (color names only)

October 14 - BEGINNING OF CONCEPT OF ODD AND EVEN NUMBERS.

Holding up 2 white rods I said: "Here are 2 little twins. "What can they sit on? (red!) "Are there some other rods that will take some different twins?" They discovered the red-purple-dark green-brown-orange (2,4,6,8,10!) "Can you find any rod that cannot take twins exactly?" They quickly discovered light green-yellow-black-blue (3,5,7,9) could not take twins exactly. One little boy said: "You forgot a color!" "You forgot white!" (1) "It cannot take 2 twin rods."

This twin game worked easily into multiplication idea as they said 2 of the red equals purple; or the red goes "2 times" on the purple, etc. etc.

October 15 - BEGINNING OF CONCEPT OF DIVISION

Following the story of the "twin rods on one bench" or 2 rods on one rod the children worked out how many twin stories fitted evenly on rods (value 2,4,6,8, 10) They followed the language idea of division by saying "I can divide the space on the purple rod (4) into 2 red rods," or "I can divide the orange rod into space for 2 yellow rods, etc. etc.

October 16 - DIVISION WITH REMAINDERS

Beginning with the black rod (7) we looked for "twins" that could fit. They discovered 2 light greens - with a space left over. We put a white rod there,and told our stories thus: "The black rod space can be divided

October 16 - Cont'd

into 2 light greens and one white left over.

I told them we sometimes called the white "left over" the remainder but they preferred to stay with the terms "divided...into" and "left over." They worked out division stories for 3,5,7,9 (known to them as yet only as colors - not numbers)

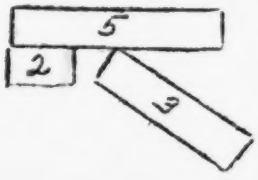
October 19 - - A large chart of the rods in color and length staircase sequence with the number values was displayed to help explain Cuisenaire Rods to parents at Open House. The children admired it. We said nothing about the numbers. One child commented "that means first, second, third, etc. as you walk up the staircase." None as yet tried to identify the number specifically with the certain rod. This was to be the last week of work without number values -- so the chart served as a silent visual introduction to number values of the rods, with no explanation.

We had been discussing the term square and looked at the white rod as having a square surface. I asked them how they could make a red square and discovered this:

Quickly they began to try to make "squares" for other colors. Some did not get the idea easily. One child who finished first said: "That's easy ...you can see it gets one longer each time so you have to make it one rod wider each time to make it square."

October 20 - SUBTRACTION

Following a review of our adding stories we played taking away one rod and got this story: "The dark green rod take away the red leaves purple" - or - "If you take purple from the dark green you have red left. They showed them on their tables thus:



(no numbers used by children)

October 21 - A TEST IN ADDITION

The teacher held up 2 rods end to end and the children found one rod that would fit exactly and laid it out. In spite of not seeing the 2 rods close by on their desks, but at a distance in my hands, most of them found answers quickly. Those who were incorrect could come to me, lay their rod on mine - note their error - go back to their tables and find the right rod.

October 22 - A GAME: "WHAT ROD DO I HAVE?"

Holding one rod behind my back, the children were encouraged to guess after they had asked 4 questions .. Is it longer than .. Is it shorter than --. The winning guesser got to hide the next rod -- and the children very quickly learned to ask the most revealing questions.

October 23 - A PAPER GAME (see sample)

Repeat of mimeo paper used October 9 -- with one new rule: "You must put the right rod in the right place the first try." Later they told "stories" they saw in the rod groupings. There was much more speed and accuracy than on the first attempt October 9. Children could see patterns for adding, for subtraction, for longer than, shorter than, for twins (beginning of multiplication and division ideas).

October 26 - INTRODUCTION OF NUMERALS (NUMBER NAMES) TO COLOR RODS

"Lets pretend we have only the white rods. "How could you build the first four steps of our staircase?" (A few children glanced at large staircase chart, others proceeded alone) "How could you prove you are right?" (Children put red-1.green-purple rods beside steps-built in upright position) "If we call this little white rod one what could we call others?" Now the rods have two names: as "red" or "2" (Children played game of holding up rod when I called by numeral.) "Could you make adding stories from these four rods?" (Children made stories and told in 2 ways -- with color names

October 26 - Cont'd

and new number names)

We wrote a story on the board both ways.

October 27 - LEARNING THE "5" AND SYMBOLS FOR "ADD" AND "EQUALS"

Procedure as before for yellow rod 5

We are learning that number names can take the place of color names. Illustrate on board. "Here is something that can take the place of "and"." Teacher demonstrates and uses + sign in addition.

Same procedure for "equals"

We call these things that stand for other things "symbols" -- What symbols do we know already? "The numerals 0 1 2 3 4 5 6 7 8 9 and + and - (Later in the year an activity will be the making of "My book of Symbols")

October 28 - INTRODUCTION OF 6

Use of Subtraction stories with new number identifications. (Same procedure as October 26) Introduction of word "subtract".

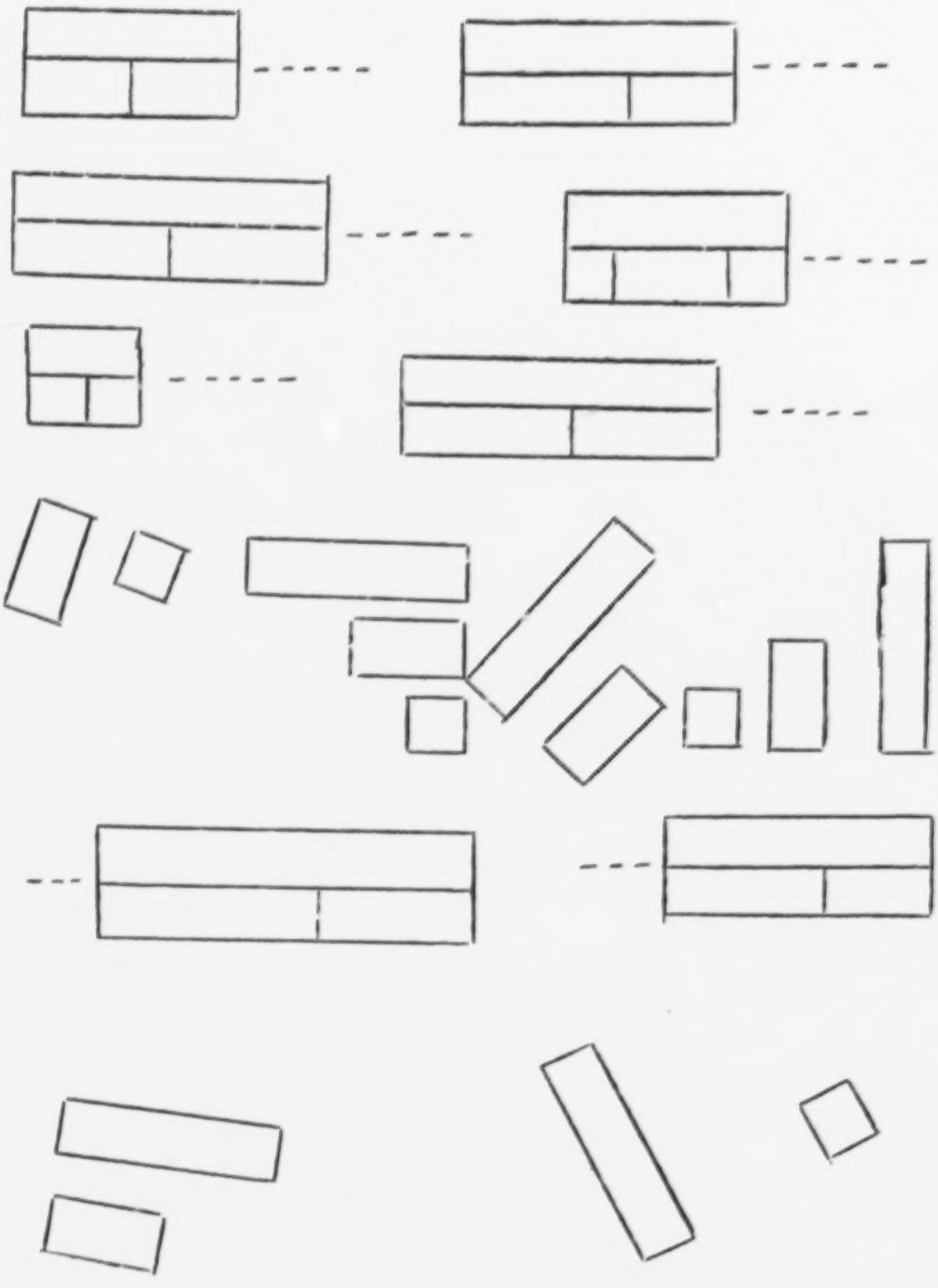
October 29 - INTRODUCTION OF 7

(Same procedures -- and review)

October 30 - INTRODUCTION OF 8

Same as before. Stating of 2 addition and 2 subtraction stories whenever possible.

One child volunteered story -- "I can'divide' the 8 into 2 "4's"."



(See Lessons for Oct. 9 and Oct. 23)

CUISENAIRE CALENDAR - NOVEMBER 1964

November 2, 1964 - ADDITION STORIES FOR 7 or 8
INTRODUCTION OF "X" OR ☐ AS A NEW SYMBOL

The girls used the 7, the boys used the 8 -- making 2 or 3 car "trains". Later they dictated their adding stories to me as I recorded them on the chalk board. They soon learned not to repeat a story which had been told. Later I wrote a story using a "box" or "X" as 3 + ☐ = 7 or 2 + "X" = 8. They learned how it was used and called the " ☐ " or "box" another symbol.

November 3 - STORIES ABOUT NINE

Using either 2 or 3 or 4 or 5 rods, the children were encouraged to make addition stories for the blue 9. The student teacher recorded stories on the chalk board in the proper listing of 2 rods 3 rods 4 rods or 5 rods used.

For the first time the children wrote down on paper the "stories" they saw in the rods on their own desks.

November 4 - INTRODUCING THE WORD EQUATION

We discussed briefly the use of sentences as "Dick and Jane can play". The teacher wrote a "number sentence on the chalk board - and told them that "we call a number sentence an 'equation'". Children said "equation" sounds like "equals" and we demonstrated that this is true.

Together we worked out these equations on chalkboard:

1 + ☐ + 5 = 9

2 + 3 + ☐ = 10

2 + ☐ + ☐ = 8

☐ + 3 + 2 + 1 = 10

4 + ☐ + 1 = 7

3 + 1 + ☐ = 6

November 4 - cont'd.

The children told each equation two ways and by colors, by numbers.

November 5 - LEARNING TO WRITE EQUATIONS

As a writing lesson the children wrote on paper simple dictated equations similar to yesterdays work.

Teacher corrected mistakes in writing, in a few, number reversals, etc. etc. Then the teacher suggested that they take their rods and try to solve the equations, without help. Five had perfect papers, 6 missed only one equation, the others seemed confused and did not do so well.

Evaluation -- the teacher expected too much too soon! We will do these things to help them: --

a) Go back and strengthen number-color relationships for some.

b) Make simpler one-step equations.

c) Take a few children in a small group around the long table where they can get more individual help.

d) Work and check equations together for a lesson or two before they venture independently.

(This is an experimental approach and we must expect some mistakes -- by the teacher as well as the pupils)

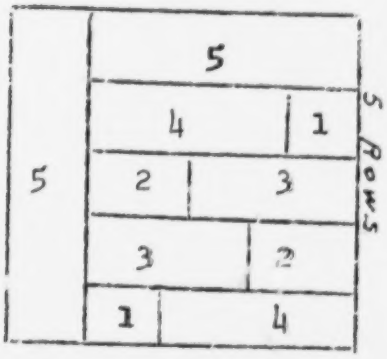
November 6 - INDIVIDUAL HELP

Using ideas under November 5 (evaluations a,b,c,d.) we worked in small groups doing the things most helpful for each child's understanding.

November 9 - A DISCOVERY ABOUT ADDING STORIES

Using the 7, 8 or 9 rod - we made "2 train" adding stories, being sure that each one was different. Then we put that numbered rod in an upright position and discovered 7 rows for 7, eight rows for 8, etc. See sample for 5.

November 9 cont'd.



One child said "because the rods get one bigger each time, we get one more row of addition". Another said: "Now we can have a way to be sure we have told all the 2 number stories for any rod we use".

November 10 - REPEAT OF BUILDING ADDING STORIES - CONTINUING IDEAS OF NOV. 9

One child said "Will this trick work for subtraction too?" Some said "Yes" others "No". They agreed to try it on Wednesday. (The teacher could have suggested that the same formation could be used for either process -- but they agreed to experiment on Wednesday.)

November 11 - SUBTRACTION STORIES

They worked out the idea by first taking away 1, then 2, etc. etc. and discovered that they could look at the same rod pictures (see Nov. 9) and tell either addition or subtraction stories from them.

November 12 - "TEEN"NUMBERS

"Suppose I asked you to show me 12 -- what would you do? They showed me in two different ways:

10	1	1
10	2	

We discussed that 13, 14, 15 etc. etc. means a 10 and a 5, etc. Each child laid out all the teen numbers on his desk so quickly and easily, there seems to be no teaching to do!

Holding up the teen rod groupings, the teacher got the children to identify them in a mixed order as 17, 13, 19, etc. etc.

November 13 - REVIEW OF "TEENS"

Making adding stories for 12, 13, etc. and dictating them to the teacher.

November 16 - INTRODUCTION OF "½"

"Let's pretend that our rods are sticks of candy. Put out an orange (10), brown (8), dark green (6), purple (4) and red (2). Using other rods to help you -- can you think of a way to show me a half of your candy sticks, so that we will each have the same size piece?"

Children began putting 2 yellows under orange, 2 purples under brown etc. Then they told me

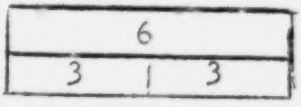
½ of orange is yellow or

½ of 10 is 5 or ½ of 10 = 5

etc. etc. The teacher showed them how we write "½ of" and recorded them as the children told them.

November 17 - REPEAT OF "½" OF" -- WITH A WAY TO PROVE

After children all showed me that ½ of 6 = 3 with a rod picture,



they were asked to prove that they were right. A few began putting six ones under the picture. Then we played "one for me" -- "one for you" to prove that ½ of 6 has to be 3.

They worked and proved others.

November 18 - FINDING "½ OF" TEEN NUMBERS

Combining their 2 new learnings "teens" and "½ of" the children worked out

½ of 12 to ½ of 20

and dictated them as I recorded them.

November 19 - (SEE ATTACHED MIMEO PAPER.) WORKING WITHOUT RODS

Children were asked to write in the numbers they thought they saw-- and to write on the back of the paper any number stories they saw — in addition, subtraction, or "½ of".

November 19 - cont'd.

Later we checked together and corrected errors -- Then children colored their rod pictures correctly.

November 20 - MAKING 20's.

Children easily made and told such stories as 23 is 2 10's and a "3" or 2 orange and a light green. Without actually telling them place value of ten and one, the children saw the 2 tens -- and demonstrated the 3 (or 3 ones as some children did it).

November 23 - November 24

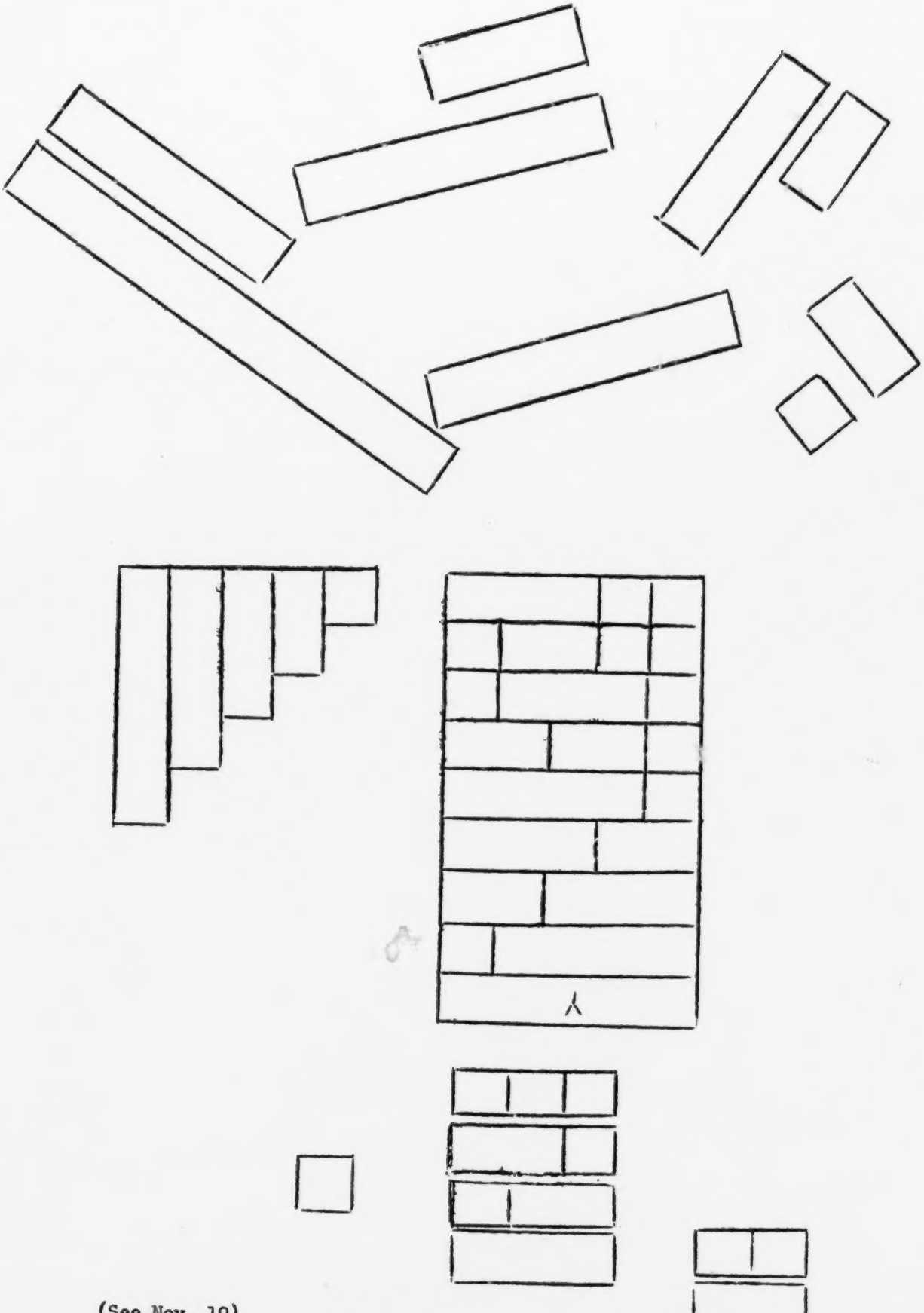
No formal lessons with Cuisenaire rods (due to a Thanksgiving program). However free play time with the rods showed much more awareness of mathematical design -- steps in many variations, "trains" using many rods (filled in solidly) and some three dimensional designs.

November 25 - TEACHING OF TIME

There are two areas where Cuisenaire rods are not as effective as the real thing - i.e. - teaching of use of money and time. With small movable clock dials the children experimented and learned minute and hour hand positions and telling of time (by hours only).

November 30 - TEACHING OF TIME

Use of clock dials to learn half hour times. (It will be interesting to observe how much is remembered about number relationships and Cuisenaire rods when the class goes back to them on December 1 -- after about 10 days without formal teaching.)



(See Nov. 19)

CUISENAIRE CALENDAR

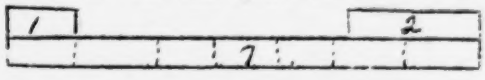
December, 1964

December 1 - FUN WITH ADDITION (SIMPLE MIMEO PAPER) (using rods)

We did a few problems together, then class tried the first 2 rows. Those who could succeed independently went on to finish. Those who needed help worked at the big table with student teacher.

December 4 - MAKING EQUATIONS

"Put out a '7'. Now put a '1' on the left and a '2' on the right. What is the missing rod?'



"Now give the equation (orally first, then written on board.

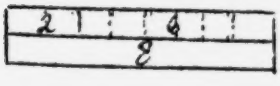
$1 + \square + 2 = 7$

$1 + 4 + 2 = 7$

December 5 and 6 ((WORK WITH TIME AND MODEL CLOCKS)

Rods for play experience.

December 7 - THE WHOLE STORY IDEA



$2 + 6 = 8$

$6 + 2 = 8$ Children made one rod "picture"

$8 - 6 = 2$ which showed this.

$8 - 2 = 6$

They discovered that 2 addition stories and 2 subtraction stories can be made from one rod picture.

December 8 - WHOLE STORY(REPEATED)

Each child had to complete in writing 2 whole stories. Later we discovered why there could be only 1 addition and 1 subtraction in a "doubles" picture as $3 + 3 = 6$

$6 - 3 = 3$

December 9-LEARNING TO THINK WITHOUT RODS

Children were given a simple addition paper and told to complete it with or without rods as they wished. Better than 2/3 of the class chose to do it without. All were praised for their good work.

December 10 - LEARNING TO FIND "1/2 of" (REVIEW)

The quicker children went into finding 1/3 or 1/4 also.

December 11 - THE PROBLEM APPROACH TO 1/3 and 1/4.

Simple stories such as 6 donuts, 3 children, 8 cookies, 4 children developed 1/3 and 1/4 concepts. The final development of the day for quicker children went to 1/3 of 18, 1/4 of 20, 1/2 of 16, etc.

December 14 - MORE STORY PROBLEMS 1/2, 1/3, 1/4

December 15-16 INTRODUCTION OF MULTIPLICATION

"Take 4 of the '3s' or take '3' 4 times."

4 X 3 = 12. Show it also as:

4 4 4 = 12

Discovery by experiment -- that 4 X 5 = 20

5 X 4 = 20 are related.

A Junior High Math instructor who came to observe math with Cuisenaire Rods in the primary, made 3 favorable comments:

a) all the children were participating

b) the children were gaining much manual dexterity in free play construction

c) the rods were a way to make children know that math can be fun

December 17 - MULTIPLICATION PROBLEMS

"The Toy Shop".. Blocks $1, Games $2, Dolls $4, etc. "How many did you sell today? "I sold 6 games." 6 X 2 = 12 or

$2 + 2 + 2 + 2 + 2 + 2 = 12

December 17 - cont'd.

"Multiplication is so much quicker." At end of "toy shop" experience, the children had done these problems:

6 X 3

2 X 1

4 X 5 (2/3 of the class got all correct.

5 X 4 Many others only missed one.)

8 X 2

9 X 6

December 18 - SPECIAL WORK WITH SLOWER CHILDREN

Two approaches to addition - with objects and symbols in sets - and with rods.

December 21 - MULTIPLICATION WHEN ONLY THE ANSWER IS KNOWN. (BEGINNING OF DIVISION

"Suppose I gave you just the answers to multiplication problems -- could you make the problem?"

"Try. . . = 12

= 20

= 18

= 10

= 14

December 22 - A NEW WAY TO SAY 3 X 4 = 12

We could say "there are 3 of the "4s" in 12 or there are 3 "4s' in 12. Problems worked out to prove it. We were really "dividing" in 12 into 3 equal parts.

December 23 - INTRODUCTION OF THE FORM OF DIVISION AND SYMBOL ÷

"How many "4s" in 20? We could use a new symbol ÷ and say: 20 ÷ 5 = 4

(Problems to illustrate division)

CUISENAIRE CALENDAR - JANUARY

January 4, 1965 - REVIEW OF OPERATIONS AND SYMBOLS LEARNED.

Children showed a good recall of facts learned and a lively interest in math. (Lesson given by student teacher)

January 5, 1965 - A SIMPLE PROBLEM TEST WHICH WAS READ TO THE CHILDREN.

They wrote answers -- and were encouraged to "use your rods" or "think the answers without rods". Of the 29 participating, 19 used rods. A few children used finger counting - successfully!)

January 6 - COMPLETED THE LAST 10 OF THE STORY PROBLEMS.

Test indicated:

a) Need for more help in subtraction.

b) Need for more listening skills in problem type thinking.

c) A natural reversion to "finger addition or subtraction instead of the rods - with mostly right answers.

d) Most simple addition was done without rods.

e) More children returned to use of the rods on the second day -- and got more correct answers.

January 7 - "DO ME FIRST"

Presentation of the parenthesis as a new symbol. Introduced as similar to the "framing" we do with our hands when we find a word on a reading chart. Student teacher and children worked on very simple equations using the ( ) which the children and I called "Do me first". Lesson ended when I put up a colorful chart.

"A Puzzle for You"

$(\frac{1}{2}$ of $4) + 2 =$ ☐

$\frac{1}{2}$ of $(4 + 2) =$ ☐

"Will you get the same answers in the boxes? We will find out the answer on Friday."

January 7 - cont'd.

Two children figured it out correctly and said to me "secretly" -- "It <u>does</u> make a difference where you put the "Do Me First". Others got partial answers -- but all had to wait until Friday to be sure about it.

January 8 - MORE EXPERIENCE WITH THE ( ) - -

and solving the answer to the Puzzle from Thursday. Working on chalkboard the children saw the use of the ( ) - - but not all were able to do the 2 step equations.

January 11 - DRAWING PICTURES OF "$\frac{1}{2}$ of"

Using 1 inch squared paper -- and the proper rod colors the children each drew a "$\frac{1}{2}$ of" picture from $\frac{1}{2}$ of 2 to $\frac{1}{2}$ of 20. We mounted the best drawings on our cork board -- looked at them and discovered that we had found $\frac{1}{2}$ of even numbers only -- because odd numbers would "leave something left over" or "would not fit".

Then looking at the pictures of our "$\frac{1}{2}$ of" we worked out simple equations using our new symbol of the ( ) as

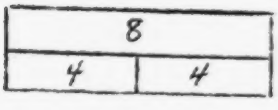
$$(\tfrac{1}{2} \text{ of } 6) + 3 =$$

$$4 + (\tfrac{1}{2} \text{ of } 10) =$$

Most of the class succeeded today.

January 12 - "FOUR WAYS TO SAY IT"

Still referring to colored drawings we had made and labeled as



we learned that we could say

$\frac{1}{2}$ of 8 = 4

2 X 4 = 8

4 + 4 = 8

8 - 4 = 4

4 ways!

January 12 cont'd.

Each child did some correctly. Some did more than others -- They are always encouraged to "do as many as you can" - (This encourages the little slow ones ... and challenges the faster ones -- with no time for boredom or mischief!)

January 13 - SPECIAL HELP FOR THE SLOW OR CONFUSED CHILDREN IN WORK DONE YESTERDAY.

Most trouble was in <u>writing</u> the facts they saw in the rods. Some brighter children volunteered to help the slower ones. Other successful children were content with free play with the rods (new designs invented every day!)

January 14 - DIVIDING A DOZEN

Starting with a dozen pencils (new term: 12 = one dozen) and children to give them to -- they played a game and came up with these possibilities of dividing them evenly:

$\frac{1}{2}$ of 12, $\frac{1}{3}$ of 12, $\frac{1}{4}$ of 12, $\frac{1}{6}$ of 12, $\frac{1}{12}$ of 12. Each step was recorded on chalkboard and worked out by <u>all</u> with the rods - after a child divided the pencils among the "actors".

<u>Extended activity</u> (with no demonstration or help) -- "How many ways could you divide 2 dozen pencils evenly?"

January 15 - LEARNING 2 NEW SYMBOLS $>$ and $<$.

Introduced as a shorter way of saying it.

7 is more than 3 -5 is less than 9

$7 > 3$

$5 < 9$

Children were helped in remembering that the larger number goes by the larger part of the sign and reverse, as

$8 > 4$

$4 < 8$

January 15 cont'd.

Children enjoyed symbols -- and did quite a lot of it during free time -- taking to it like a new secret code.

January 18 - COMBINING TWO NEW SYMBOLS

Children worked out several equations.

More Than - or Less Than

$4 < (3 + 3)$

$7 \quad (\frac{1}{2} \text{ of } 8)$

$8 \quad (10 - 1)$

$6 \quad (2 \times 4)$

January 19 - WE INVENT A NEW SYMBOL

We discussed our work done on Monday. Remembering that for some primary one children the notation or "writing it down" is the hardest part, I asked some of them what troubled them the most. They agreed that it was remembering what the answer to the "Do Me First" was -- and if they wrote it "up above" it got "all mixed up". They agreed it was just a "thinking" number. I asked them how "just thinking" was shown in some story books and they showed me this: ( ) --"like it's in your mind" .. "you think it but don't see it". So we decided to call ( ) our "thinking number symbol" and now they do their equations thus -- if they need the help.

$(\overset{6}{(}\ 7 - 2\ ) \times 3 = 15$ $\qquad\qquad$ $6 + (\overset{\frac{1}{3}}{(}\ \text{of } 12\ ) = 10$

January 20 - UNDERSTANDING 10's and 1's.

Using only our orange and white rods we discovered that 10 ones are the same as 1 ten, that after you show 9 ones the next step is really 1 ten. We saw it as place value on the chalkboard.

January 20 - cont'd.

Tens	Ones
1	6
2	4
3	0
	9 etc. etc.

Children demonstrated with rods how to make numbers to 49. Then working with partners they made numbers up to 99. Each time they had to report orally, as "we have 6 tens and 7 ones -- that is 67".

January 21 - REVIEW 10's and 1's

We demonstrated to yesterday's absentees the use of orange 10 and white 1 to show 2 place numbers -- Then using orange crayolas and white chalk we "drew" numbers dictated by the teacher. Each child reported orally one he had drawn as "I drew 4 orange lines for 4 tens and 9 white lines for 9 ones. My number is _ ? _". (Children guessed)

January 22 - USING MONEY (tens ones)

We discussed U.S. coins. Then discovered which rods could stand for a dime (orange), a nickel (yellow) and a penny (white). Learned new symbol for cents -- ¢. They discovered different ways to make 10¢, 15¢, 20¢, 25¢ and lunch money - 35¢.

January 25 - Review for Cuisenaire Mid Year Test + - x ÷ etc. see sample

January 26, 27 - Test given (except equations)

January 28 - Review of equations and symbols

January 29 - Completion of Test

JANUARY - CUISENAIRE CALENDAR

The Mid Year Test indicated a successful level of achievement. Twenty scores were 90 or above. The diversity and scope of test material indicated mathematical awareness of concepts and processes. Other children working in published workbooks have never achieved that level of math thinking at Primary One mid year in my experience.

Above 8 to 10 children are still slow and confused in some concepts and in ability to write down their answers. It seems indicated to divide the group into two sections -- permitting the better ones to move into more advanced thinking, and permitting the slower one to repeat basic operations and understandings in Cuisenaire math teaching.

CUISENAIRE RODS - A Mid-Year Test - p^1

Dear Parents,

If you visited Room 9, Primary One, on "Open House" night or during "American Education Week" you heard about (or saw in action" Cuisenaire Rods being used in your child's classroom. This test at mid-year is:

a) to evaluate the learning and teaching of beginning mathematics by this Cuisenaire method and

b) to char* your child's individual progress in his class.

NAME_____DATE_____

Addition	(15)	
Subtraction	(15)	
Multiplication	(15)	
Division	(15)	
Symbols	(10)	
Number System	(10)	
Simple Equations	(20)	
TOTAL TEST - 100		* Your Child's Score
		Class Median
		Rating

Addition

2 + 3 =	2 + 2 =
4 + 1 =	6 + 2 =
5 + 2 =	3 + 4 =
1 + 3 =	5 + 3 =
8 + 2 =	1 + 9 =
2 + 7 =	4 + 4 =
4 + 5 =	3 + 3 =

2 + 3 + 1 + 4 =

Score ☐

Subtraction

4 - 1 =	8 - 4 =
3 - 2 =	9 - 3 =
5 - 3 =	10 - 4 =
2 - 1 =	10 - 5 =
6 - 2 =	8 - 2 =
5 - 2 =	6 - 3 =
7 - 3 =	7 - 5 =
10 - 8 =	

Score ☐

Multiplication

2 X 3 =
2 X 2 =
2 X 5 =
2 X 1 =
2 X 4 =
2 X 6 =
2 X 7 =
4 X 4 =

3 X 4 =
3 X 2 =
3 X 1 =
4 X 3 =
4 X 2 =
4 X 1 =
5 X 2 =

Score ☐

Division

6 ÷ 2 =
4 ÷ 2 =
8 ÷ 2 =
9 ÷ 3 =
6 ÷ 3 =
10 ÷ 2 =
12 ÷ 2 =
10 ÷ 5 =

$\frac{1}{2}$ of 4
$\frac{1}{2}$ of 8
$\frac{1}{2}$ of 10
$\frac{1}{2}$ of 6
$\frac{1}{3}$ of 9
$\frac{1}{2}$ of 12
$\frac{1}{3}$ of 12

Score ☐

Match These Symbols and Meanings

Add	÷
"Take Away"	?
Equals	×
○ or □ or △	>
More Than	=
Less Than	<
"Do Me First"	( )
"one-half of"	−
"Times"	½ of
"Divided by"	+

Score [ ]

Number System (Tens and Ones)

26= _____ tens _____ ones
50= _____ tens _____ ones
18= _____ tens _____ ones
7= _____ tens _____ ones
89= _____ tens _____ ones

3 tens, 4 ones =
1 ten, 5 ones =
4 tens, (no ones)=
5 tens, 5 ones =
8 ones =

Score [ ]

Simple Equations (2 points each)

$2 + \square + 3 + 1 = 10$

$2 \times (4 + 1) =$

$(\frac{1}{2}$ of $4) + 3 =$

$8 + 2 - 1 =$

$7 - 3 + 2 =$

$4 + (\frac{1}{2}$ of $10) =$

$6 + 1 + 2 + \square = 12$

More Than or Less Than

$8 \square (\frac{1}{2}$ of $4)$

$6 \square (3 + 5)$

$34 \square$ 2 tens, 8 ones

Score $\square$

NUMBER STORIES - ADDITION AND SUBTRACTION
(Draw the pictures and find the answers)

1. Mother made six cookies.
   Sally ate four of them. How many are left?

2. Jack and Tom are playing with their cars.
   Jack has five cars and Tom has four cars.
   How many have they together?

3. Our teacher put up four good drawings.
   The next day she put up four more.
   How many did she put up?

4. Mr. Stricker had eight big red balls.
   Two of them were lost. How many does he have now?

5. Three little girls were playing with their dolls. Susan had three dolls, Jane had two dolls and Sally had two dolls. How many did they have to play with all together?

6. On our science table there were six pretty big shells. A boy brought two

more shells. How many are there now?

7. At a birthday party a little girl had five nice presents. Her family gave her three more presents. How many presents has she?

8. There were nine pretty tulips in our garden. The wind blew four of them away. How many tulips are left?

9. There are ten red apples in Mother's kitchen. She took six of them for a pie. How many apples are there now?

10. The boys are flying kites. There are four big kites and three smaller kites up high. How many kites are flying?

11. In Jane's home there are three small chairs, six big chairs and one rocking chair. How many chairs have they?

12. In a sand box there were eight sand pails. Three children took their pails home. How many were left?

Number Stories Cont.

13. Mother Rabbit had six carrots. She gave three of them to Bunny Boy. How many did she have left?

14. On my block there are four big houses and five smaller houses. How many houses are there?

15. Two boys were building blocks. They had four red blocks, three blue blocks and two yellow blocks. How many did they have?

16. Nine cups were on the table. Three were broken. How many are left?

17. A teacher had nine new books. She gave her class seven of them. How many did she have left?

18. Mother made seven white cup cakes and four chocolate cup cakes. How many did she make?

19. Father used eight nails in Spot's dog house. He wanted five more. How many did he need?

Number Stories Cont.

20. Jack got milk for two cents, ice cream for five cents, and an apple for five cents. What did he have to pay?

Used orally Jan.5 and 6

Used (written), May 14

FEBRUARY — CUISENAIRE CALENDAR

Because of much repeated absence, due to contagious diseases, it did not seem advisable to move ahead into new teaching -- hence no daily record. The only new idea introduced was the use of simple equations using letter names for the colors as:

$r + y + w =$

$g - r =$

$2 \times p =$

$\frac{1}{2}$ of $p =$ etc. etc.

Much time was used helping some slower children with basic concepts. An interesting experience was the discovery of a severly color-blind child who has been able to adjust with very little special help -- just by identifying the rods by length and feel as I named them by color. (His score was 83% on mid year test.

My Cuisenaire Calender

March - April
1965

The class was divided into two groups. Group I can go faster and farther in their mathematical thinking. Group II needs frequent repetitions and explanations and simple one-step problems for a while. At times the two groups may again work together for teacher's new presentations. One day a group works independently, the next day it has a lesson with the teacher.

March 1 - Group I did paper work -- simple two step equations. Group II demonstrated simple adding and subtracting problems with the rods - and wrote them. Teacher guided oral and written work.

March 2 - Group I reviewed multiplication and division and pointed out the relationship as:

$2 \times 4 = 8$ $\qquad$ $8 \div 2 = 4$

$4 \times 2 = 8$ $\qquad$ $8 \div 4 = 2$

Group II worked on simple addition and subtraction using the rods.

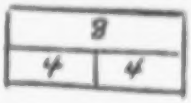
March 3 - Whole class learns new symbol $\neq$ (is not equal to). Group I then demonstrated with multiplication or division problems using " $\neq$ ". Group II demonstrated with addition or subtraction " $\neq$ ".

March 4 - Class began making a booklet -- "My Book of Symbols" -- on each page, one symbol and several examples of how to use the symbol. Group I had difficult examples. Group II had more simple illustrations.
All showed +, -, X, $\div$, $\frac{1}{2}$ of, $>$, $<$, =, ( ), and $\neq$.

March 5 - Some completed their books of symbols -- others enjoyed free play.

March 8 - Group I learned the use of " . " for X multiply and added that to their symbol book.

Group II reviewed "twins idea as:



8 - 4 = 4
2 X 4 = 8
8 ÷ 4 = 2
4 X 4 = 8

March 9 - Group I - Paper work. Use symbols $>$ or $<$ in addition, multiplication, subtraction and division.

Group II continued the "twins" idea -- some blackboard work -- after they made "twins" from rods.

March 10 - Group I used new symbol ÷ in all four processes.

Group II did "twins" paper work.

March 11 - Group I. Lesson in uneven division and term "remainder" as $13 \div 4$, $15 \div 2$, etc.

Group II. Paper work -- repeated a section of the Mid-Year Test so that I could analyze and correct errors.

March 12 - Group I made their own uneven division stories and recorded them with remainders.

Group II went over Mid-Year Test (repeated paper). Difficulties are more in notation than in understanding. (The Group II children are mostly the slower readers also. There seems to be a high correlation between ability with the rods and other subject achievements).

March 15 - (Whole class) -- a continuous equation on blackboard -- "How many ways can you show the meaning of "8" without using the figure 8?" Children recorded $4 + 4 = \frac{1}{2}$ of $16 = 12 - 4 = 16 \div 2$, etc. etc. After

March 15 cont'd.

demonstration the children took long strips of paper -- (like adding machine roll) and worked out independently the same idea for 10. In the allotted time the best record was 35 different ways (about 25 minutes). Two-thirds of the class did 20 or more, the least capable child did 6. All understood the idea.

March 16 - Demonstration for Dr. Garrison, superintendent.

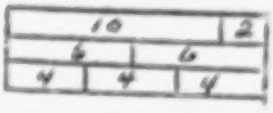
Group I dictated symbols to me which I recorded on the board -- then divided themselves so that each person was working on a different symbol. They worked out ways to show the use of the symbol. After about 5 minutes they dictated to me what they had found with the rods.

Group II repeated the "long paper" idea -- using any number they chose (see March 15).

March 17 - 18 - Attended a reading workshop (no formal rod lessons).

March 19 - County Teacher's Meeting.

March 22 - 26 - Spring vacation.

March 29 - (Whole class) Dividing 12 -- comparison of fractional parts. Moving from $\frac{1}{2}$ of 12 which they could do - we did $\frac{1}{3}$ of 12, $\frac{1}{4}$ of 12, $\frac{1}{6}$ of 12, $\frac{1}{12}$ of 12 -- so that they could compare sizes.

$\frac{1}{2}$ of 12

$\frac{1}{3}$ of 12

The children saw visually that the more parts there were, the smaller each part became.

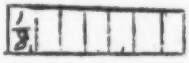
March 30 - Group I worked independently dividing 24, as they had divided 12 -- and wrote their findings.

Group II - I carried the fractional part to a more simple

March 30 cont'd.

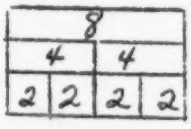
presentation of "a cake for supper" -- divided according to the number in the family.

Gail's family



Tim's family, etc.

Then they used the 8 rod (a chocolate cake!) and divided it in different ways with the rods.



March 31 - A free day. "You can do any kind of number paper you like. Think carefully -- use your rods." Wide variety of results -- everyone of the 27 children did something independently and accurately.

April - Next year this group will be in with children who used workbooks. The month of April will be spent in drill type addition and subtraction with or without use of rods -- with textbooks.

April 17 - Thus far these Primary One children have gone faster and with more accuracy in addition and subtraction facts from a textbook than have other groups in other years who learned the facts by drill and without rods.

May - June - During the months of May - June, we will return to the Cuisenaire rods -- using them in various ways for problem solving.

C. Loomis

MY CUISENAIRE CALENDAR - MAY

Theme - Using the rods to solve problems.

May 3, 1965 - USING SCOTT-FORESMAN (Arithmetic Readiness) picture cards of grouping (sets) the children were encouraged to tell simple adding and subtracting stories (balls, candy, clown hats, etc.). Then they showed with the rods the same simple problems and gave the answers.

May 4 - Repeated lesson with attention to words that give clues as "all together" or "more" for addition, and "left" or "gone" for subtraction. Children exchanged tables several times to see other's picture cards and the rod stories to match them.

May 5 - (Sets of tens and ones in problem solving). Using the Scott-Foresman picture-number grouping cards for tens and ones the children quickly recognized the numbers pictured. They showed them with their rods (orange as ten, white as one). Told each other their picture stories and rod stories and numbers.

May 6 - (Original Stories using picture card tens-ones idea) answering each others problems after solving them with the rods. Examples: "A boy had 3 bags of marbles with 10 in each bag and 7 more marbles. How many did he have?" "A storekeeper had 46 dolls. He sold one box of 10 dolls. How many were left?"

May 7 - Writing an orignal problem and illustrating it (no visual clues). Reading it to class -- which solved each problem read. Special attention given to the language of problem solving. Accurate statements and questions required. Rod used to find answers.

May 10 - 11 - (Problems from a textbook -- Row Peterson Book 2). Children worked independently at their own speeds, using rods when they neededthem. Teacher spent time encouraging, checking and at times demonstrating individually with the rods.

May 12 - 13 - (Using multiplication and division in problem solving). The children made "twin stories which they easily remembered -- using the rods. Then they made original story problems from what they saw in the rods. The children could see the close relationship of addition and multiplication; and of subtraction and division. They also saw for the first time that a problem could be solved with more than one equation as 2 X 5 = 10 or 5 + 5 = 10, etc.

May 14 - Simple problem test (see sample). All but 5 of the 27 children succeeded -- (i.e. not more than one problem incorrect). The 5 children who did poorly were all able to get at least 50% of the problems correct.

May 17 - (Formulating a question for a given problem), see sample. This oral lesson gave children experience in recognizing what was implied in problem statements, and what kind of question would make sense. Rods used for answers.

May 18 - Same as May 17 only with written questions. This involved language and writing skills and careful reading as well as math comprehension.

May 19 - Lunchroom problems -- Lunch money, milk dessert, etc. and getting and giving money as they experience it daily. (Here real money is superior to the rods.)

May 20 - Substitute teacher (I.T.A. meeting)

May 21 - More simple money problems.

(Note -- Free play experience with the rods are still enjoyed by the group. When there is free choice time, about 1/2 of the group choose the rods instead of games or drawing or library. Their designs and structures show balance, unity and geometric concepts. Originality and creativity is encouraged.)

May 24 - Experimentation

Brief discussion of the difference between free play and experimenting with the rods. "When you are trying to find out something special that you can do

May 24 cont'd.

with the rods as numbers -- that's experimenting." Children were asked to experiemnt to find out some new kind of problem that they could see in the rods. A few worked in twos...most worked individually.

One boy worked out a problem with a remainder in division, other worked out 1/3, 1/4, 1/6, etc., others did 2 steps of addition or subtraction, etc. and other 2 step problems.

May 25 - (Sharing Our Experiment)

"Yesterday we experimented. Today you may show -- just one good problem with your rods." The children then went from table group to table group -- looking at the rods and listening to the story problems told. They checked each other's answers and detected a few slight errors. (This was a good way for all the children to share their thinking and experimentation.)

May 26 - 27 - (Using fractional parts of numbers)

Children made problems of 1/5 of, 1/3 of, 1/2 of, etc., etc. Some problems were quite complex as 1/7 of 28, others as simple as 1/2 of 4. All children succeeded at their maturity level.

May 28 - A "Problem Parade"

The other primary one room had written a little newspaper and mounted it in the hall. In our primary one, each child dictated a problem to Mrs. Loomis. These problems on 9 X 12 paper were mounted on our wall.

A room committee mounted the printed problems, numbered them and prepared an answer "key for the other room. We went to read their newspaper -- they came to read and solve our "problem parade".

A few sample problems:

"Mother gave each of her 2 girls 5 dolls. How many dolls do the girls have?" (Elysia)

"Joe had 10 puppies. His mother sold 1/2 of them. How many puppies were left?' (Charles)

May 28 cont'd.

"A toy store had 18 toys. They sold 6 of them. How many toys were left?" (Laurie)

"Tom had 9 baseball cards. Dick gave him 8 more. How many cards did Tom have all together?" (Michael)

"Lonnie had 24 stamps. He used 1/2 of them. How many stamps did Lonnie have then?" (Scott)

"Pete had 5 cars. He lost 4 cars. His mother bought 3 more cars for Pete. How many cars did Pete have?" (Julie)

MAKING PROBLEMS

Write the questions-- work the problems -- tell if you used ADDITION or SUBTRACTION to get the answer. Draw pictures if you need them to help you.

1. Susan had three large paper dolls. Her mother gave her six more.

2. There were four kites up high and two kites down lower.

3. Jack had ten cents to spend. He bought ice cream for seven cents.

4. Mother had a rope seven feet long. She cut off three feet for a jumping rope for Sally.

5. Six children were at a birthday party. Mother had only four party plates.

MAKING PROBLEMS

Write the questions-- work the problems -- tell if you used ADLITION or SUBTRACTION to get the answer. Draw pictures if you need them to help you.

6. Bobby had a pencil box. He had four yellow pencils, two red pencils and one blue pencil.

7. Mother baked a dozen little cookies. The children ate five of them.

8. Sally had three toys on the top shelf, two toys on the middle shelf, and four animal toys on the bottom shelf.

9. Dick had ten marbles. Peter had only two marbles.

10. In February a plant was 4 inches tall. Early in March it was 12 inches tall.

MAKING PROBLEMS

Write the questions-- work the problems --- tell if you used ADDITION or SUBTRACTION to get the answer. Draw pictures if you need them to help you.

11. Dick is eight years old. Sally is four years old.

12. G randmother used six quarts of milk, but Mother used ten quarts for her family.

13. On our block there are five girls and four boys.

14. Mother had a dozen oranges. She used half of them.

15. Robert is six years old. His sister is fifteen years old.

Used May 17 and 18

Evaluation of Cuisenaire Rods in Primary One

Teaching and learning primary one mathematics by the use of Cuisenaire rods was a challenge to the teacher and the pupils. It was a successful experiment for these reasons:

1) Every child participated every day.
2) Every child could work at his level of achievement and succeed.
3) The very shy or non-verbal child had a media by which he could express his thinking.
4) The children enjoyed the math periods and fussed if anything kept them from using the rods.
5) Discovering, experimenting, manipulating -- led to comprehension of math concepts far beyond the traditional primary "areas of learning".
6) Computational skills of addition and subtraction were equal to -- and in most cases superior to skills of other children I have taught by drill methods.
7) Children enjoyed rods but did not become too attached to them. In many cases the use of rods was left to their own decision and the children knew their own limitation -- to use or not to use.
8) Many math symbols were learned and used. This will be a good introduction to the new math program as they progress through school.

Cuisenaire rods cannot do everything. They are not the best device for teaching time or measuring or money.

The Cuisenaire rods can help greatly in the teaching of our new math texts (SRA). They have value in teaching in many grades beyond primary one.

In conclusion...Cuisenaire rods are not intended to be a system of teaching mathematics. Rather, they are the most useful, fascinating and

challenging math materials I have ever used. Any teacher using them will have many opportunities to develop creative math thinking by her group, and creative thinking as a teacher of mathematics.